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"Popper" induced methemoglobinemia

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ABSTRACT

Methemoglobinemia is a blood disorder in which red blood cells contain methemoglobin, a form of hemoglobin that contains iron in its oxidized state, at levels >1%, often leading to a hypoxic state. It can be acquired or congenital and has been associated with nitrate or nitrite exposure. "Poppers" and "Rush" are slang terms given to drugs of the chemical class called amyl nitrate or isobutyl nitrite, which are typically inhaled and can be found over the counter. They are used with the intention of enhancing sexual performance due to their vasodilator effects, anal sphincter relaxation, and aphrodisia. We report a case of a man who developed methemoglobinemia secondary to "popper" abuse.

KEYWORDS Amyl nitrates; methemoglobinemia; popper

Poppers are inhalants with an underestimated potential for abuse, commonly used for sexual experience enhancement. They are typically sold and marketed as air fresheners, leather cleaners, nail polish removers, liquid incense, and deodorizers.[1] These products contain a chemical substance known as amyl nitrite, which is well documented to jeopardize health by causing methemoglobinemia.[2] As these agents are readily absorbed through any body surface, their toxic effects can appear within 30 seconds of use.[3] The effects can range from headache, dizziness, weakness, and confusion to life-threatening neurotoxicity, profound hypoxemia leading to respiratory depression, coma, shock, and seizures.[4,5]

CASE PRESENTATION

A 42-year-old man with known hypertension presented to the emergency department with complaints of headache, nausea, dizziness, dyspnea, left lower extremity numbness, and bluish discoloration of his skin. Symptoms had started 6 hours prior to presentation, immediately following the inhalation of the liquid product marketed under the name "Rush."

During the first medical assessment, the patient was anxious-appearing, alert, and oriented, moving all extremities normally, and had prominent cyanosis of his lips and bilateral palms *(Figure 1a)*. Vital signs included a blood pressure of 128/95 mm Hg, a heart rate of 120 beats/min, a respiratory rate of 20 breaths/min, a temperature of 98°F, and an oxygen saturation of 88% measured by pulse oximetry. The remainder of the physical exam was unremarkable. Electrocardiogram revealed sinus tachycardia. Arterial blood gas (ABG) analysis on 6 L nasal cannula showed a pH of 7.51, partial pressure of carbon dioxide of 14 mm Hg, partial pressure of oxygen of 179 mm Hg, bicarbonate of 12 mmol/L, and methemoglobin of 19.8%. A urine toxicology screen was negative. Oxygen supplementation was started via nasal cannula of up to 6 L with no improvement of oxygen saturation.

Methemoglobinemia was diagnosed. Methylene blue (MB) was administered at a dose of 1 mg/kg infused over 5 minutes. The patient was reassessed periodically during the next couple of hours, with improvement of both his cyanosis *(Figure 1b)* and other symptoms, as well as normalization of oxygen saturation measured with pulse oximetry. His follow-up ABG the next day revealed an oxygen saturation of 98.9% and an undetectable level of methemoglobin. On direct questioning prior to discharge, the patient explained that he was using "poppers" or "Rush" for sexual enhancement.

DISCUSSION

Among the many substances linked to methemoglobinemia, amyl nitrite "popper"-induced methemoglobinemia cases are increasing at an alarming rate. Amyl nitrite products

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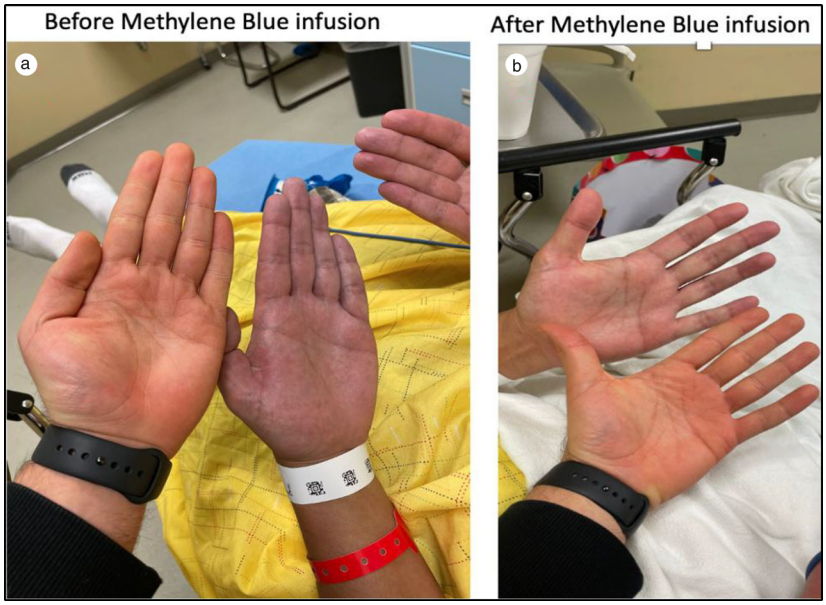

Figure 1. **(a)** Gray/blue discoloration of the palms after inhalation of poppers. **(b)** Reversal of discoloration after methylene blue administration.

are sold in glass vials under the brand names Rush, Super Rush, Jungle Juice, Locker Room, Sub-Zero, and Iron Horse, among others. The diagnosis can be suspected by a suggestive history and confirmed with ABG analysis utilizing a co-oximetry to directly measure the oxygen saturation (percentage of oxyhemoglobin), as opposed to calculating it from the partial pressure of oxygen, which usually results in inaccurate results depending on oxygen supplementation.[6] The unreliability of routine, two-wavelength pulse oximetry in cases of methemoglobinemia is due to methemoglobin's ability to absorb light at both wavelengths emitted by the pulse oximeter, resulting in an inaccurate estimate of oxygen saturation that does not correct with oxygen supplementation; readings are usually in the 85% to 88% range, as seen in our patient, regardless of true oxygen saturation.[7]

Management consists of initial resuscitative and stabilizing measures such as securing the patient's airway and providing oxygen supplementation. MB treatment is initiated if the methemoglobin level is >30% or in the presence of symptoms regardless of methemoglobin.[8,9] The dose for MB is 1 to 2 mg/kg intravenously, given over 5 minutes.[10] Reevaluation is recommended 30 to 60 minutes after MB administration, and a repeat dose can be given if no clinical improvement is seen or the methemoglobin percentage does not decrease.[8,9] Ascorbic acid can be used whenever MB is contraindicated.[11,12] We report this case to emphasize the importance of obtaining a thorough history at the time of presentation to pick up on essential clues, to include methemoglobinemia, in the differential of any patient with signs or symptoms of hypoxia that is refractory to oxygen supplementation.

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